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Wireless LANs

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| UHR ELR Pilot Tones Clarification |
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Abstract

There appear to be some contradicting statements in D0.2 on the handling of pilot tones for ELR PPDUs. We propose to clarify the issue.

# Introduction

There is some ambiguity between different places in the 802.11bn D0.2 spec when it comes to the location of the pilot tones for an ELR PPDU.

# Discussion

The requirements for ELR pilot tones come up in a number of places in 802.11bn D0.2.

### Clause 38.3.16.8 Pilot Subcarriers),

In clause 38.3.16.8 (Pilot Subcarriers), we find:



The relevant Table in 27.3.12.13 appears to be Table 27-40—Pilot indices for 52-tone RU transmission, more specifically, the row corresponding to PPDU BW 20 MHz:



### Clause 38.3.10.11 (Construction of ELR-SIG) and Clause 38.3.16.7 (Frequency domain duplication)

In 38.3.10.11, we find:



Note that duplication of the *entire* 52-tone RU (which includes the 4 pilot tones), results in the pilots ending up in different locations from what is shown in Table 27-40.

Specifically, per Table 27-8, the 52-tone RRUs are specified as:



There is a shift of 53 tones between, e.g. RRU1 and RRU2. Shifting the RRU1 Pilots {‑116, ‑102, ‑90, ‑76} over 53 tones, we would get: {‑63, ‑49, ‑37, ‑23}, which is inconsistent with Table 27‑40.

Additionally, 38.3.16.7 makes a similar statement:



# Conclusion

It appears that “frequency domain duplication” is not properly defined for the pilot tones of ELR.

We believe the proper allocation of pilot tones is the one described in clause 38.3.16.8 (Pilot Subcarriers). Other instances of frequency duplication for ELR should be made consistent with this description.

# Proposed resolution

The proposed change for sections 38.3.10.11 and 38.3.16.7 is shown below with highlights in red.

------------------ Begin text proposal --------------------

1. Pilot insertion: Insert pilots as described in 38.3.16.8 (Pilot subcarriers) for UHR ELR PPDU.
2. Frequency domain duplication: For a UHR ELR PPDU, steps d)-f) are done for each of the four 52-tone RRUs in a 20 MHz bandwidth (modulating the same data on each one) ~~the 52-tone RRU 1, and then the 52-tone RRU 1 is duplicated to the 52-tone RRU 2, 52-tone RRU 3 and 52-tone RRU 4~~ as described in 38.3.15.12 (ELR-SIG).
3. Apply PAPR reduction mask on data tones, as described in ~~38.3.15.12 (ELR-SIG)~~ 38.3.16.7.

**38.3.16.7 Frequency domain duplication**

The ELR-SIG and payload portion of the UHR ELR PPDU are transmitted over 52-tone regular RU

(RRU52) with four times duplication in frequency domain across four RRU52s (RRU52 4x DUP) in 20

MHz. The frequency domain duplication is described as follows:

* Encoding and BPSK or QPSK modulation are done for each of the 52-tone RRUs in the 20 MHz bandwidth. The same data is modulated on each of the four RRUs (i.e. 52-tone RU1 to RU4 in Table 27-8). ~~RRU 1 (the RU 1 for 52-tone RU in Table 27-8 (Data and pilot subcarrier indices for RUs in a 20 MHz HE PPDU and in a non-OFDMA 20 MHz HE PPDU) in 20 MHz PPDU, and then the 52-tone RRU 1 is duplicated to the 52-tone RRU 2, 52-tone RRU 3 and 52-tone RRU 4 in 20 MHz PPDU.~~
* The phase rotation of -1 shall be applied on data subcarriers of the lower half of the 52-tone RRU 3 and the upper half of the 52-tone RRU 4 in 20 MHz PPDU to reduce PAPR, as illustrated in Figure 38-24 (RRU52 4x DUP). See Equation (38-50) to Equation (38-52) for further details. This phase rotation of -1 is not applied on pilot subcarriers.
* The above frequency domain duplication over four 52-tone RRUs occurs after LDPC tone mapping operation if LDPC encoding is used or after constellation mapping operation if BCC encoding is used.

------------------ End text proposal --------------------